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# **INHALATION THERAPY TECHNIQUE**



# INHALATION THERAPY TECHNIQUE

BY  
W. E. COLLISON

With Foreword by  
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## ACKNOWLEDGMENT

THE author wishes to acknowledge his indebtedness in the preparation of this small volume.

To literature which has been published upon Inhalation Therapy.

To individual members of the Medical Profession.

To the British Medical Association for permission to reprint the description of the Collison Inhaler from the *British Medical Journal* of February 2nd, 1935, which appears in the addenda.

He also wishes to acknowledge his indebtedness for permission to reprint extracts from contemporary literature on the treatment of asthma, pneumonia, and T.B. by inhalation, which also appear in the addenda.



## FOREWORD

MUCH has been written upon the subject of treatment by inhalation of drugs, but a considerable proportion has appeared in the German language, and particularly so about the fine atomisation of liquids and their absorption by the respiratory tract.

Few, if indeed any, busy medical men can find time to read what has been written, so Major Collison has placed the Profession under an obligation in making so complete a review of this literature and reducing it within the compass of this small and abbreviated work.

By great personal effort and experiment he has produced a machine which can be relied on as an instrument of precision whenever required, and the dosage can be reckoned correctly.

Major Collison has not attempted to encroach on the functions of the doctor or tried to teach him his job.

He has contented himself with explaining many of the points in relation to inhalation which have required elucidation.

For example, he makes it clear how much drug is absorbed and in what period, and deals with the fineness



and density of the vapour which are necessary before the ultimate ramifications of the respiratory tract can be reached.

This Brochure will enable a medical man to explain the working of the Collison Inhaler to his patients in a way which should be understandable by all.

Having prescribed this method of treatment in many cases, I am pleased to write this brief foreword commending the perusal of Major Collison's book to every practising physician and to such surgeons as can spare the time to extend their knowledge in this interesting field of work.

BRUCE BRUCE-PORTER.

## PREFACE

THE object of this small volume is to provide a “ map ” and serve as a guide to those who are unacquainted with the “ geography ” of Inhalation Therapy as we possess it to-day.

It includes cardinal points governing the atomisation of liquids which reach the entire pulmonary surfaces by inhalation, and their absorption and dosage, with a brief outline of the development of the therapy.

The Indications of Treatment for various conditions are intended to be examples of the kind of prescription that is employed, and are included for this purpose only.

From a mass of information which I have collected since 1924, I have tried to give a brief and concise survey of the subject, and hope that it may in some degree facilitate the prescribing of remedies by inhalation.

W. E. C.

87 ECCLESTON SQUARE,  
LONDON, S.W.1.  
*May, 1935.*



# INHALATION THERAPY TECHNIQUE

## I

### INHALATION THERAPY

THE recent and perfected methods which have come into use in the administration of oxygen and atomised liquids have been foreshadowed from the earliest times and are a culminating point in the slow development of centuries.

The application of remedies to the seat of the disease has always made an instinctive appeal, and in the case of lung conditions we are fortunate in having on record many interesting accounts of the methods that were employed.

We find that Hippocrates turned his thoughts towards their local treatment and made use of an inhaler by means of which the vapour was produced by heat, and it is interesting to read of his kindly thoughts towards his patients, which are shown by his providing egg shells or damp sponges, which were attached to the mouth-piece to prevent the lips being burnt.

There was probably little difference between his heated vessel, which was covered with the hollowed half of a wild gourd or colocynth, and similar contrivances which are still exhibited for sale to-day.

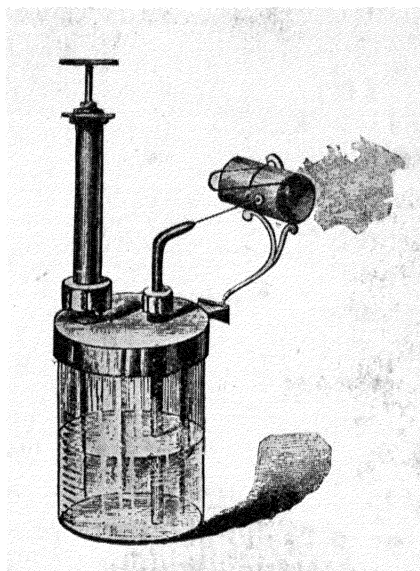
We also find it recorded that sulphur fumes and those of burnt ship ropes and fir cones were employed in the third and fourth century, and that the Arabian physician Rhazes advocated balsamic inhalations in the ninth century.

From that period onwards there does not appear to be anything of particular or outstanding interest recorded until the discovery of oxygen in 1774. Its use in medicine appears to have been limited at that time, and its value questioned until the middle of the last century, when Loewry carried out his experimental work and established its efficacy in certain conditions.

While attention was given to the uses of oxygen, the local treatment of the lungs was being considered from another angle—that of the application of atomised liquids. Fountains were constructed by Lobethal in about 1840, and a little later by Hirzel, which atomised sea water in small rooms.

At that period we find the waters from certain wells being applied to medical purposes in a similar way, such as the sulphur springs at Pierrefond, where Sales-Girons constructed an atomiser in 1856. He was among the first to give his attention to the vaporization of other liquids.

It was he who produced the first atomiser. It consisted of a small vessel from which liquid was drawn and thrown against a metal disc by a small hand pump, thus producing the spray or vapour. This method was improved some years later by Lewin, who pumped air

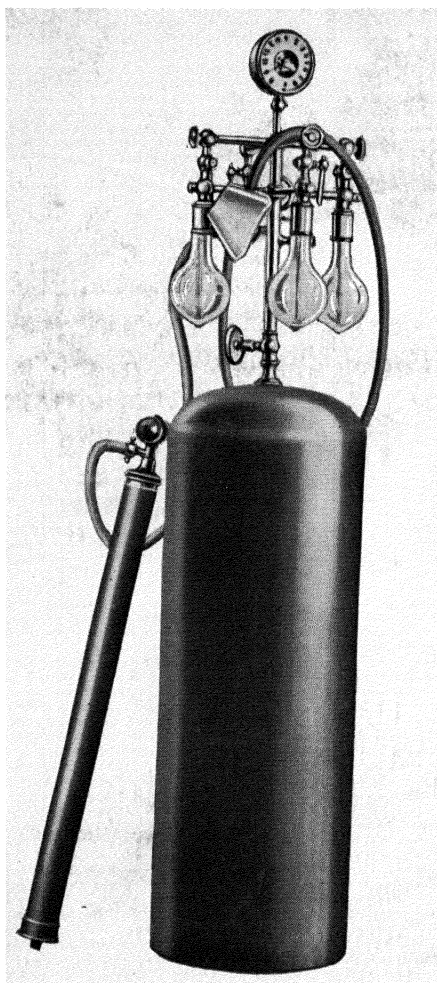


Georg Lewin's Hand Atomiser. c. 1860.









Alabone's Inhaler, with Compressed Air Cylinder and Hand Pump. c. 1890.

into the reservoir containing the liquid, causing a more steady stream of liquid to escape, and he increased the density of the vapour by providing a convex disc upon which it impinged. Both used a round metal screen as illustrated for the purpose of giving it direction.

In 1862, Bergson used the principle which is still employed to-day. He placed two tubes at right-angles with the ends close to each other. A strong transverse current of air passed through one of them in a horizontal position over the top of the other, which was held vertically. The lower end was immersed in liquid, which was drawn up and dispersed in vapour.

A great variety of atomisers were evolved and elaborated at this period, which illustrate the interest in the method which became general. Literature appeared from then onwards in England, France, Germany, Hungary and Russia, and also in America, representing an enormous sum total of work carried out upon the absorbing capacity of the lungs.

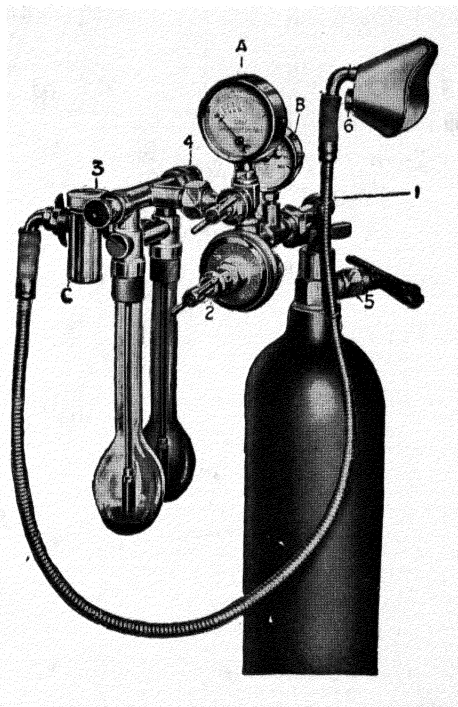
In this country, Morell Mackenzie, and later Beigal, gave the subject their attention, and the former provided valuable evidence that atomised liquids reached the respiratory tract. Alabone constructed and used an atomiser in 1894 which was worked by compressed air pumped up by hand, and it may be that he brought the method from America to England where it had been in use for many years.

One may perhaps fairly say that the modern aspect of inhalation therapy dates from about 1863. At this

period Georg Lewin wrote: "It is well recognised that the mucous membrane of the respiratory tract is capable of rapid absorption." From then onwards literature has been published covering a wide field of investigation, and the work of Professor Heubner and Professor Hückel of the Pharmacological Institute of Gottingen, and others, on the inhalation of atomised liquids with the use of modern apparatus, has summarised, augmented and provided the data upon which the therapy now rests.

For many years we see the use of oxygen employed quite independently to that of atomised liquids, but gradually the two branches of the therapy drew together until their combination occurred at the beginning of the present century.

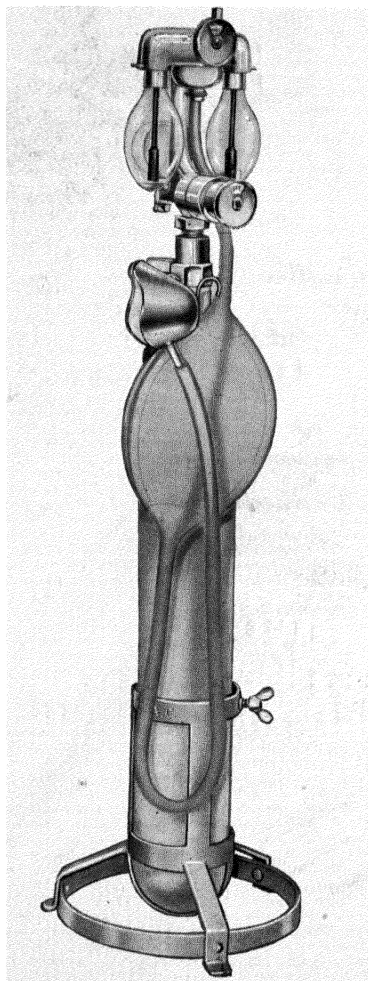
In 1902, Professor Spiess of Frankfurt introduced his inhaler, which incorporated the use of oxygen and atomised liquids. His method was extensively used throughout Germany and during the Great War. This apparatus was introduced into England by Mr. P. S. Douglas-Hamilton and myself in 1924, and was exhibited at the British Medical Association Exhibition (which was held in Bath in the following year), and in subsequent years until 1932, when the Collison Inhaler was exhibited for the first time at the Association's Exhibition at the Imperial Institute in London.



Spiess-Dräger Inhaler mounted on Oxygen Cylinder.  
1902.







The Collison Inhaler mounted on Oxygen Cylinder.  
1932.

## II

### OXYGEN AND ATOMISED LIQUIDS

IN cases in which air reaches the lungs in insufficient quantities, the employment of oxygen is *a priori* reasonable, and although its value is generally accepted and its use universal, the results at times are disappointing in the extreme.

As has been recently stated in medical literature on the subject, one reason for negative results is due to the unsatisfactory methods of administration, such as the use of glass funnels and the like, and there are good grounds for belief that in these circumstances the amount of oxygen reaching the patient is inadequate, and for this reason has little if any therapeutic value, apart from providing no proper measure or dosage.

These results seldom occur when use is made of inhalation methods which are embodied in the Collison inhaler, as the oxygen reaching the lungs is assured, while pathological conditions can be changed by the introduction of suitable inhalants direct to the pulmonary surfaces.

The amount of oxygen breathed by the patient is observed by the movements of the bag which is provided



with the inhaler, and the flow regulated to equal the amount being inhaled. In this way the patient is given a known amount over definite periods and demonstrably inhaling it by the movements of the bag. The correct method of inhaling is fully set out on page 25.

Pathological conditions of the lungs are treated by the direct application of the inhalants in the form of a vapour inhaled with the oxygen, and as these conditions are usually present when oxygen is indicated, inhalants form its natural counterpart. Conditions which do not yield to the more usual forms of therapy respond to this method, and even chronic cases can be afforded amelioration, if not a fair measure of recovery.

There are many conditions which fall into this category, such as dyspnœa, when oxygen is prescribed and a camphor inhalant vaporized with it to stimulate the breathing.

The primary factor always remains constant that oxygen and inhalants must reach the pulmonary surfaces, and negative or negligible results will follow in cases of shallow breathing or where the face mask does not fit the face properly and the patient breathes air for the most part, instead of the oxygen and atomised liquids.

The general practice is to employ oxygen as the atomising agent. Air has been found to have an enervating or other effect upon some patients. This may be due to the fact that experiments have demonstrated that atomisation robs air of oxygen, and apprehension over its employment was felt in the early days on this

account. Sales-Girons stated that this should not cause anxiety, on the grounds that patients did well suffering from pulmonary diseases living in high altitudes relatively poor in oxygen. The clinical fact, however, remains true, and may have a definite bearing when atomised air is breathed from a face mask.

The inhalation of mineral waters atomised by air has been reported to produce dyspnoea and a tendency to suffocation, and sometimes followed by hæmoptysis. These symptoms have not been reported when oxygen has been the atomising agent, and its partial or entire employment has been general since its use for this purpose became practicable.

In Germany, when a large amount of vapour is required to fill a room or to supply a large number of inhalers, the general practice is to install special equipment whereby the atomising agent consists partly of air and partly of oxygen.

The use of air has been more or less limited to hand sprays, and its employment confined to quite short inhalations of a palliative nature to stop an asthma attack or for the treatment of the upper air passages. Medical opinion does not appear to be in favour of the inhalation of air with atomised liquids over any appreciable period, and when used for T.B. conditions a number of short inhalations are preferred to one long treatment.

A mixture of CO<sup>2</sup> and oxygen is also used as an atomising agent, but the more usual practice among

## 8            INHALATION THERAPY TECHNIQUE

those who employ atomised liquids is to use pure oxygen with the addition of a camphor inhalant, which definitely stimulates the breathing and is valuable in other ways.

### III

## ABSORPTION

ABSORPTION of atomised liquids by the respiratory tract, finer bronchi and alveoli has been established and repeatedly corroborated during the latter half of last century and since, and also the absorption of solid particles, about which much work has been accomplished in connection with industrial disease.

Long before the introduction of perfected inhalers, such investigators as Georg Lewin, in 1863, demonstrated this fact, and in 1882 Oertel published his classical work "Respiratorische Therapie."

They were followed by others, who each in their turn confirmed and elaborated the work of their predecessors, tabulating microscopic observations, amounts absorbed and clinical data.

Claude Bernard demonstrated that the respiratory tract absorbed more quickly than the intestines. J. Wasbutsky's investigations showed that ferrocyanides and iodides appeared five or ten minutes after intratracheal application.

Heubner and Rona proved that calcium chloride passed into the circulation by intratracheal injection, and quicker still by inhalation than by hypodermic injection.

Frank Fraenkel experimented with inhalations of tuberculin, and likewise found very quick absorption.

Laqueur and Heubner thus used insulin and found that it can be inhaled by normal people as well as by sufferers from diabetes in such quantities to cause hypoglycæmia in the former and a reduction of sugar content in the latter.

Sikorsky, J. Wittich and Kuttner found by histological examination that absorption takes place in the network of very small canals which are situated between the cells and the epithelium of the bronchi and alveoli.

Heubner came to the conclusion that the concentration is not less than a five- or ten-thousandth part of the original concentration of the inhaled liquid, and states that this is considerable if one considers elective active preparations as atropine or adrenalin, which account for the more active results in their inhalation for bronchial-asthmatic attack, and their greater freedom from collateral action than any other method of application.

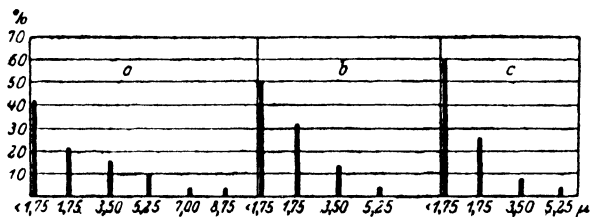
He found that by inhalation with the Spiess-Dräger apparatus he could trace reaction in the urine after twenty minutes. He also found that atomised liquids reach in recognisable amount the region of the small bronchi, and that they will reach the alveoli if the particles are a suitable size and density. He mentions that considerable difficulty is met with in carrying out these experiments, as the lungs absorb so quickly.

In 1925, Hückel published his work on inhalation vapours, which was carried out with modern apparatus.

He established that the measurement of the vapour particles must approximate  $5\ \mu$  downwards to be carried during inhalation to the finer bronchi and alveoli, and be dense enough to produce adequate action.

The findings embodied in his report were and are particularly important, as the vapour produced by inadequate apparatus is indistinguishable to the naked eye from that produced by those which are suitable, and is useless for the treatment of many pulmonary conditions. It is neither fine enough nor dense enough to be carried to the finer bronchi and alveoli to be effective. The larger particles of vapour become collected in the throat and conveyed to the digestive organs, often with disagreeable and harmful results, as is the case with the common hand spray.

The fineness of vapour varies with the alteration in pressure, and Hückel states that as a general rule in the nebulisation of fluids the degree of nebulisation increases with increasing pressure. He prepared the chart which set out the results of his experiments, *i.e.* :—

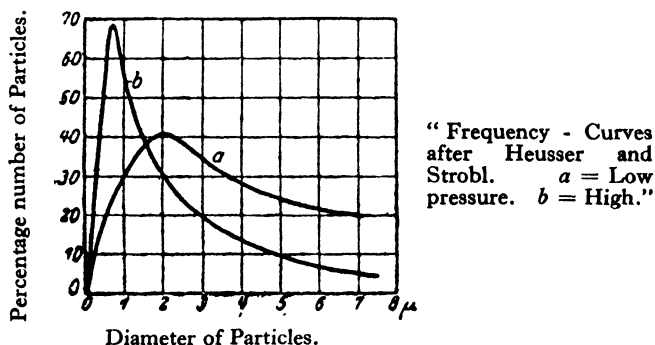


(Standard Nebuliser without condenser, Glycerine water.)

*a* = 1 atmosphere. *b* =  $2\frac{1}{2}$  atmospheres. *c* = 5 atmospheres.

Ordinate = number of particles per cent. Abscissa = Diameter of particles.

This result corresponded exactly with the Heusser-Strobl frequency curves, *i.e.* :—



With increasing pressure, the larger particles diminish and disappear, while the small and smallest increase in quantity. In actual practice, even at comparatively high pressures, the vapour is fine enough to reach the finer bronchi and alveoli, but as the pressure is further increased the proportion of smaller particles increases, and it may be taken that a relatively greater number reach this area.

As a consequence, it appears to be established that a fine vapour composed of particles measuring approximately  $5\mu$  downwards can only be produced from inhaling apparatus working under constant and steady high pressure.

The following table shows the approximate pressures used to produce a sufficiently fine vapour to reach the finer bronchi and alveoli in such apparatus as the Spiess-Dräger, Hirth and Collison Inhalers, which are con-

structed for attachment to oxygen or air cylinders under pressure.

Rate of Flow of Vapour. Litres per min.	Pressure.	
	Lb. per sq. in.	Atmospheres.
5	20	1-1/3
10	35	2-1/3
15	70	4-2/3

In normal breathing, about 10 litres of vapour per minute are used, and the usual pressure approximates 35 lb. per square inch, or 2-1/3 atmospheres, compared with the negligible pressures used in the earlier inhalers which were pumped up by hand, and the electrical atomisers which work under an average pressure of 5 to 6 lb. per square inch, or under one half an atmosphere only.

These pressures are those maintained behind the nebulisers, and are distinct from any slight plenum of the vapour as it leaves the face mask, which is regulated to correspond to the inspiration of the patient.

An adequate amount of vapour will be deposited in the finer bronchi and alveoli only when, in addition to the vapour being fine and dense enough, there exists sufficient volume reaching the face mask for normal or deep inspiration. All experiments have borne out the necessity of there being no kind of vapour shortage.

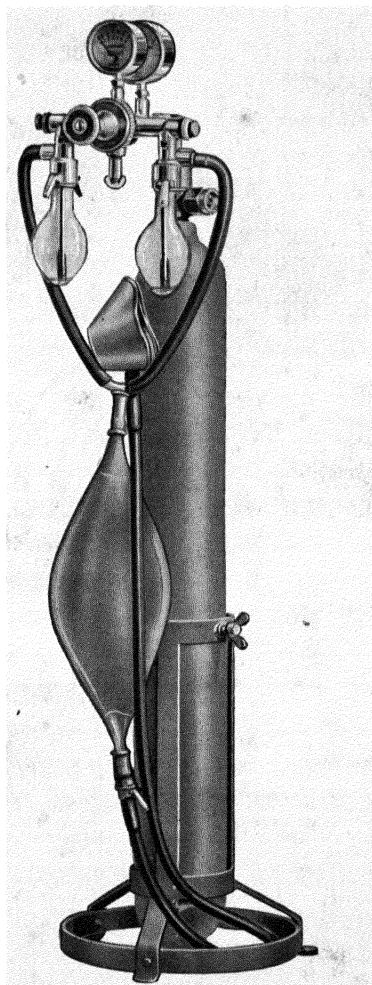


The volume required varies, but one may estimate this to approximate 8 to 10 litres a minute in calm breathing, though this is considerably above or below in many individuals. Heubner put the amount at 12 litres a minute, and although this may approximate the average Teutonic expansion it is, I believe, on the high side for this country. Taking 8 litres a minute to be the total volume of air breathed in during one minute, the rate or speed of breathing into the lungs is 16 litres a minute, as only a half minute is thus occupied, the other half being taken up with expiration.

Provision is made for an ample volume of oxygen and vapour in the Collison and Hirth inhalers by a storage bag, and it only remains to be observed that the patient is breathing from it.

Some apparatus do not possess this provision, and it is then necessary to regulate the vapour to flow, if possible, to approximate the full 16 litres or more per minute, to provide 8 litres during inhalation per minute, while 8 litres are wasted during exhalation.

Unfortunately, this is seldom understood by those employing types of inhalers without storage bags, and a compromise is reached owing to waste of oxygen during exhalation, and also owing to the patient being unable to tolerate the vapour flowing at 16 litres due to too great a density produced by the higher pressure, which relatively increases it. The reduced flow of 5 to 7 litres does not provide a sufficient amount for normal or sufficiently deep breathing, and the particles of inhalant



The Hirth Inhaler mounted on Oxygen Cylinder.  
c. 1926.



are unlikely to reach the whole of the bronchial tree, as inspiration is not deep enough to carry them to the finer bronchi and alveoli, or on the other hand, air is breathed in from the sides of the mask which dilutes the vapour and reduces its density.

This is illustrated by some apparatus without storage bags being commended for the reason that they are economical in oxygen, which makes them unsuitable for the requirements of modern medicine for the reason described.

Clinical observations have frequently demonstrated that patients who have made little or no progress under treatment with a flow of vapour at 5 to 6 litres a minute from inhalers without storage bags have immediately responded to it when this has been increased.

<i>Inhalers with Storage Bag.</i>				
Drug Wastage.		Total Drug Inhaled.	Drug Exhaled and not Absorbed.	Drug Absorbed.
In Tube, etc., passing to Mask.	During Exhalation.			
15 per cent.	Nil.	85 per cent.	40/45 per cent.	40/45 per cent.
<i>Inhalers without Storage Bag.</i>				
10 per cent.	45 per cent.	45 per cent.	20/25 per cent.	20/25 per cent.

An indication of the ever-widening use that is being made of the absorbing capacities of the lungs is illustrated by its employment outside pulmonary conditions.

As instances of this we observe the treatment of diabetes. Insulin is atomised with oxygen, which possesses its own therapeutic value. The treatment also of cardiac conditions ; here again oxygen is employed. It possesses the additional advantage that such preparations as adrenalin and camphor can be repeatedly and safely employed owing to the smallness of the dose and freedom from any kind of shock.

## IV DOSAGE

DOSAGE is a cardinal factor in any therapy, and in relation to inhalation the desideratum appears to have been reached.

It is based upon the action of pharmacologically active agents upon the pulmonary surfaces, and is expressed in terms of time, which approximate the following table :—

EQUIVALENTS OF PERIODS OF INHALING AND ABSORPTION FOR COLLISON INHALER.		
Period of Inhaling.	Drug absorbed by Patient. Approx. in Minims.	
	One Phial Nebulising.	Two Phials Nebulising.
20 minutes	7 minims.	8½ minims
15 minutes	5¼ minims	6¼ minims
10 minutes	3½ minims	4¼ minims
5 minutes	1¾ minims	2½ minims
1 min. 4 sec.	½ minim	4/7th minim

The table, however, is based upon vapour which is produced by a pressure of  $2\frac{1}{3}$  atmospheres (*i.e.*, "Medium" on the dial of the Collison Inhaler), and which provides a volume of 10 litres per minute. As a general rule any appreciably less volume would be inadequate, as it would be below that inspired by the patient, and the density of particles would likewise be less owing to the reduced pressure with the reduced rate of flow.

Vapour produced by a pressure of  $1\frac{1}{3}$  or less atmospheres does not possess so great a density of the smallest particles as that produced by the higher pressures, and for this reason the term "Weak" has been chosen to indicate this on the Collison Inhaler when the pressure is reduced for the smaller volume.

It will be observed from the table that the actual quantity of inhalant that is absorbed is small, but the physiological effect is adequate, which is due to the inhalants being brought into direct contact with the mucous membranes of the respiratory tract.

In considering dosage by inhalation and without elaborating unnecessarily upon outstanding features, they may be grouped under the following headings :—

- (a) Infinitesimally small dose that is administered by a few moments' inhalation.
- (b) Quick reaction to irritation.
- (c) Quick local and systemic reaction.
- (d) Absence of disturbance of the digestive organs.
- (e) Absence of shock.

Prescribing is greatly facilitated by the features (a) to (d), and when introducing an inhalant which may cause irritation the mask may be held a little distance away from the face so that the vapour may be diluted with air until the result has been observed.

With regard to absence of shock. The absorbing surfaces of the lungs are estimated to approximate forty times greater than the external surfaces of the body, and therefore constitute an ideal area for the introduction of medicaments. Their natural function is to absorb gases or vapour equivalent to them, and they accordingly present a natural way of entry.

Chemically pure preparations should always be used for inhalation purposes, and only those employed which do not become unstable when atomised to such a fine degree of sub-division with oxygen, or are not thrown out of solution, when their action may be altered.

In the case of salines, the salts become extracted from the water, and for this reason it is necessary for them to be frequently renewed.

In a recent medical book on the subject of inhalation therapy it is stated that "an important advantage in this therapy is its entire lack of danger." It is difficult to understand what such a statement is intended to convey. The action of pharmacological agents introduced by inhalation is similar to that when introduced by other methods, and if they are carefully prescribed no danger of any kind is attached to their inhalation.

It makes for safety perhaps in a greater degree than



other forms of application owing to the sharp reaction to an irritant and to the smallness of the dose represented by an inhalation. I think, however, physicians will agree that general statements of this kind about any form of administration may be misleading, and especially so about any new form of therapy which is passing through a transitional period, and when information is being sought about its application.

Until comparatively recently the employment of inhalation therapy might perhaps have been regarded as comparatively free from danger, on the grounds that the term was confined to the use of hand sprays and the like, which were and are quite inadequate for transforming liquids into a vapour that will reach the finer bronchi and alveoli in sufficient density to be effective. The public have made extensive use of such appliances, which have been recently elaborated by the addition of an electric motor.

This has added to their sphere of usefulness, especially in the treatment of the upper air passages, but it has equally indicated the necessity of their being properly employed and not used in the haphazard way that was customary in the earlier hand atomisers.

When, however, one is employing oxygen apparatus vaporising pharmacologically active agents for the treatment of the entire pulmonary surfaces, the same care and knowledge is necessary in this as in any other form of application on account of their local and systemic action.

## V

### APPARATUS

UNTIL the last few years use has been made of what may be termed "clinical" pieces of apparatus which were cumbersome and difficult for patients to understand and use in their own homes, and it was necessary for physicians and others to spend much of their time in explaining how they should be worked.

This stage in the development of the therapy ended with the introduction of the Collison Inhaler in 1932, by means of which the difficulty of administration was overcome.

It presents none of the tiresome and irksome features associated with medical apparatus, and is readily understood by patients. While providing a vapour that meets the requirements of modern medicine, it embodies most simple and easily-understood controls, and is comparatively small and very compact. These features have overcome the impracticability of patients taking a proper course of duly prescribed treatment at home, and of having the inhalations available at any time and during the hours of the night.

It represents to most people a new treatment by inhalation which is actually so far removed from former

methods as to be only associated with them historically and academically.

It has brought together and combined into a single therapy the proper and assured administration of oxygen with that of atomised inhalants in such a form that

- (a) Precise and adequate dosage can be prescribed, and
- (b) that the inhalants reach and are absorbed by the finer bronchi and alveoli of the lungs.

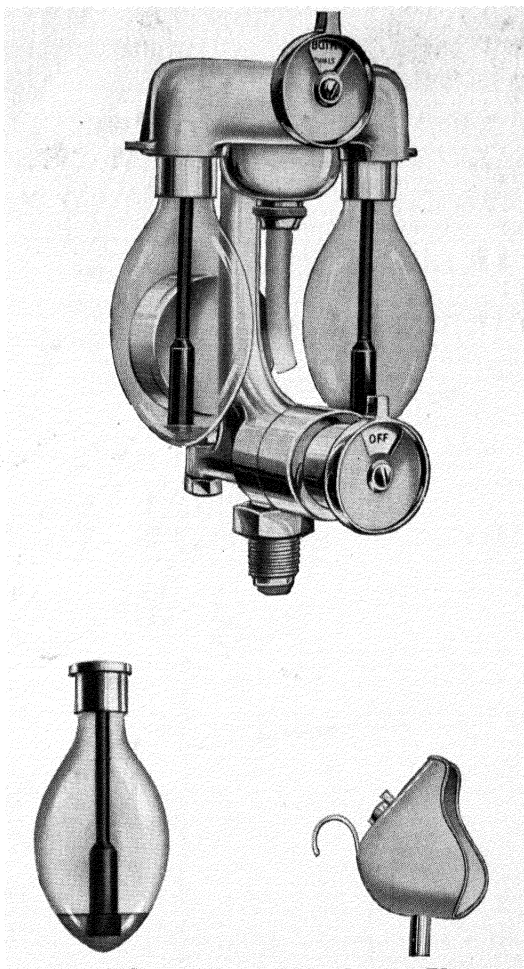
A description of the inhaler may here be helpful to perceive those conditions when its use is indicated.

*Mounted on Cylinder.* The inhaler is mounted on a cylinder of oxygen and made secure by the aid of a spanner, with which the connecting nut is tightened. It is provided with two glass phials, one of which is amber for photo-sensitive inhalants. A large teaspoonful of each inhalant to be used is placed in each. They are removed by pressing the release collar.

*Four-way Valve for Vapour and Oxygen.* By means of the control handle on the top of the inhaler, the liquids in the phials can each be vaporised separately or both together. They are vaporised by the aid of the oxygen, which is inhaled with the atomised liquids.

*Oxygen only.* Likewise, when this control handle is rotated to indicate " OXYGEN ONLY " on the dial, neither of the inhalants will be vaporised, and oxygen only will flow.

Thus, for the purpose of daily curative treatment, the white phial would be in use for the inhalation of camphor,



The Collison Inhaler, Phial and Face Mask.



menthol or creosote, and the like, and for the purpose of aborting an asthma attack or tiding over a difficult period of dyspnœa, the amber phial would come into use for an inhalation of adrenalin.

In cases of asthma, should an attack threaten when a camphor preparation or creosote only had been prescribed for daily curative treatment, the adrenalin vapour could be at any moment substituted by “ switching over ” the top handle from “ white phial ” to “ amber phial ” on the dial ; and likewise when two inhalants, such as creosote and adrenalin, are prescribed to be inhaled together, quicker action of adrenalin would be brought about by “ switching over ” from “ both phials ” on the indicator to “ amber phial ” when only adrenalin vapour would be inhaled.

*Volume Control.* The lower handle regulates the volume of oxygen and vapour leaving the inhaler, which passes into a storage bag or reservoir, and from there to the mask which is held gently against the face by the patient.

*Storage Bag or Container.* The object of the bag is as follows :—

- (1) It provides an adequate supply of oxygen and vapour for the patient to breathe.
- (2) It increases the temperature of the oxygen leaving the cylinder on its passage to the face mask.
- (3) It increases diffusion of the atomised liquids and oxygen on the kinetic theory.

- (4) It provides a positive check upon the oxygen and vapour reaching the lungs by its relative movements during inhalation and exhalation of the patient.
- (5) It conserves the oxygen and vapour which would otherwise be wasted during exhalation.

*Face Mask.* The face mask is provided with an inward and outward valve, and during exhalation through the outward valve which opens, the inlet one closes and stops the flow of oxygen and vapour from the bag to the mask.

The mask is also provided with a small hole in addition to the two valves described, to admit a small flow of air to enter for the patient to breathe with the oxygen and vapour. (The complete mask can be slipped off the tube for sterilising.)

*Oxygen Gauge.* The amount of oxygen in the cylinder is registered on the indicator for that purpose, and when half has been used a red flag appears on the dial, and a larger one when only one-quarter of the contents is left, which can leave no doubt in the mind of the patient or nurse when another cylinder should be provided. This provision is particularly valuable in cases of pneumonia or acute asthma, and when the inhaler is required during the hours of the night.

*To Start Inhaling.* To take an inhalation the oxygen is turned on at the cylinder head and the lower handle on the inhaler rotated to indicate "Medium" on the dial.

The bag will begin to fill, and the patient should hold the mask gently against the face.

*How to Breathe with the Mask.* Observation should be kept on the bag, and if it is not deflated at all when the patient inhales but steadily increases in size, it denotes that the patient is breathing in air between the mask and the face instead of oxygen and vapour from the bag. In this case the mask itself should be carefully bent to fit the face better, and if this does not succeed, a pad can be made of gauze and placed where necessary between the mask and face, or use made of the rubber pads which are made for the purpose and attached to the rim of the mask.

*Regulating Vapour correctly.* When the patient is inhaling comfortably from the bag the flow of oxygen and vapour into it from the inhaler can be quite simply regulated to equal the amount being breathed from it by turning the regulating handle one way or the other. As a general rule the bag should be kept about half full.

The usual position of the regulating handle is midway between "Weak" and "Medium" on the dial, which represents approximately a flow of 7 to 8 litres a minute.

*Coupler and Filter.* The small bowl which is attached between the two phials serves the double purpose of collecting any large particles which may reach it from the phials, and of conveying the vapour from each of the two phials to the storage bag and mask.

*At the End of Treatment.* At the end of a treatment the regulating handle should be turned to the "off"



position, and, in addition, the oxygen should also be turned off at the cylinder head with the special key which fits into the cylinder valve.

In exceptional cases and in treating young children, if it is desired to reduce the flow of vapour below the amount of air normally inhaled, two methods may be employed.

The intake valve may be removed from the mask, when the vapour will pass through the bag instead of collecting in it, and the rate of flow from the mask can be controlled with great exactitude by the lower handle on the inhaler.

When the reduced flow of vapour from the mask is below the amount required by the patient for normal breathing, the mask should be held in such a way as to allow air to enter it between the rim and the face, or the outlet valve may be removed as well as the inlet one.

When the valves are replaced, care should be taken to see that the inlet one directs the flow of vapour to the curved back of the mask and not directly out of the mask towards the face of the patient.

Another method is to allow the bag to fill with vapour until it lifts the valve in the mask, but this is not satisfactory, and an even flow cannot be regulated.

There are cases, however, when it is desired to reduce the concentration of inhalant in the vapour but to maintain an adequate supply of oxygen, in which case one phial at a time is used for an inhalant, and the other one kept empty for oxygen only to pass through, and

the four-way valve handle rotated to indicate "both phials."

By this method the density of the vapour is halved, as oxygen only is flowing from the empty phial without atomising an inhalant.

*Aqueous Liquids in Amber Phial.* It is a wise plan to use a dry clean amber phial when aqueous inhalants are renewed, otherwise sediment may collect unduly. When it is necessary to prescribe more than two inhalants to be used in a treatment, aqueous solutions should be vaporised by one nebuliser in amber phials and oil ones by the other in white phials, whenever possible.

An aqueous inhalant should not be vaporised by a nebuliser which has been used for an oil one, as the presence of oil in an aqueous liquid may render it unstable, and impair its action.

The coupler between the two phials should be cleaned periodically with methylated spirits. It is easily removed by a few turns of the milled screw underneath, after slipping off the tube and bag.

Care must be taken in replacing to see that the oblong cork washer and the bowl itself are put in the correct position, and that the small leather washer is also replaced, which goes between the base of the coupler and the milled screw, otherwise the vapour will escape.

The bag and tube should likewise be cleaned periodically by pouring warm water and Lux through them and allowing them to dry by hanging up and the water to run out.

*Cleaning Nebulisers.* Nebulisers are best cleaned by immersing them in methylated spirits and turning on the oxygen for a few seconds. This should be done when the same nebuliser is required to atomise more than one inhalant, if it is important that an inhalant with which it was "coated" should not mix with the next inhalant to be used.

Nebulisers should be renewed from time to time, and especially the one used for aqueous liquids, owing to the liquids drying on them and sometimes impairing their proper working. They are easily removed by screwing off.

## VI

### TREATMENT

THE following is a useful form of prescription that is readily understood. It represents a usual treatment for asthma, taken twice daily.

INHALATION PRESCRIPTION		
Inhalant.	Minutes.	
	Inhale.	Rest.
Adrenalin (amber phial) . . . . .	5	3
Rest . . . . .		
Adrenalin and Camphor preparation (both phials) . . . . .	5	3
Rest . . . . .		
Camphor preparation only (white phial) Rest . . . . .	5	3
Adrenalin only . . . . .	3	10
Rest . . . . .		
Total inhalation .	<u>18</u>	

Inhale through mouth.
Morning and evening.

*Date*.....

*Doctor's Signature*.....

It embodies the inhalants to be employed and the duration of each inhalation ; the intervals between each, and the number of treatments to be taken daily. The short rests are generally inserted on the grounds that they assist the comfortable absorption of the inhalants and oxygen.

The correct way of taking inhalations is to sit and lean slightly back. Garments like girdles and belts should be loosened to avoid hindering deep respiration. The chair should preferably have arms. The vapour then has an unimpeded entrance to the lungs.

The general practice appears to be not to introduce deep inspirations at first, but to be content to give an opportunity for the patient to become accustomed to the face mask and the vapour. When this stage has been reached, the correct method of inhaling must be properly understood, otherwise the vapour may only reach the mouth and pharynx, but with a little effort its penetration into the lungs can be readily acquired, and deep inspirations or respirations or both can be prescribed.

Breathing exercises are prescribed in conjunction with treatment in suitable cases.

Every care must be taken to ensure that patients use the face mask properly. At first a mistake is often made and they breathe in air from the sides or ends instead of holding it properly in the correct position on the face, so as to close up the mask all round and breathe oxygen and vapour from the storage bag. Difficulty may be experienced, and the steps that can be taken are set out very fully on page 25.

Young children may be given treatment when asleep by removing the mask and directing the vapour to the nose and mouth. When awake, it is well to cover the eyes with a handkerchief, to protect them from contact with the vapour.

In treating lung conditions, inhalations are taken through the mouth.

In cold or damp weather, patients should not go out of doors immediately after taking treatment, but wait for fifteen to twenty minutes, to avoid any risk of catching cold.

The inhaler is placed at the bedside if the patient is subject to attacks during the night, and arranged in a convenient position so that it is easily accessible for an inhalation with the minimum amount of disturbance.

Individual treatment is essential, as in any other method, and particularly so at the beginning, when the rapid action of the inhalants is very marked compared with the more usual forms of therapy, and frequent visits to a patient are often necessary on this account.

Patients may be unable to tolerate certain preparations and breathe them without discomfort or irritation, when they can either be diluted or others substituted.

They also respond differently to the same inhalant, and as an example of this, pine oil suits most patients, but in some causes dyspnœa, either immediately or after a week or ten days' treatment or more. In these cases, a camphor preparation is usually substituted, on account of its action, which definitely stimulates the breathing.

For reasons of this kind, it is not sufficient for a patient to embark upon a month's course of treatment without the action of the inhalants being carefully watched so that they may be changed if necessary.

Patients should be made to understand that they must look to the preparations prescribed for them in the white phial, such as camphor and creosote inhalants, etc., to bring about an improved state of health, and take their daily treatments regularly, whether they actually "feel" the need of them or otherwise.

In the more usual forms of therapy, larger doses are administered and absorbed into the system and a certain accumulation takes place. When administered by inhalation, the dose is smaller. There is little accumulation, and the patient is very dependent therefore upon the daily dose upon which to carry on.

For this reason, reliance must be placed upon the repeated application of small amounts represented by the daily inhalations, and not until an improved state of health has been gradually built up and definitely established can they be reduced without risk of relapse.

Owing to the great relief which asthmatics are afforded by the inhalation of adrenalin and oxygen, they are inclined to substitute it for the more curative inhalants contained in the white phial prescribed for them, which they sometimes neglect to inhale owing to their greatly improved state and freedom from asthma.

Disappointment will almost certainly overtake them, and they will find that the continued use of adrenalin

only, without any proper course of curative treatment, will cease to relieve them to the same extent, while from a medical standpoint the period of comparative or complete freedom from attack will have gone by in which the inhalation of camphor or creosote, etc., might have been so usefully employed while the asthma or asthmatic symptoms were quiescent.

Occasionally patients are filled with apprehension at the idea of placing a mask over the face, and the best plan is to allow them to hold it well away from the face at first and inhale the vapour by that method. They quickly gain confidence, and are anxious that they are inhaling properly after a few minutes, when the mask can be put in the correct position.

In these circumstances, and also when patients are very ill and weak, it is more comforting and less trying for them to use a mild inhalant like cajuput oil for the first few treatments, if possible, and then change over to something more heroic.

The period during which a course of treatment should be taken varies. The minimum in asthma and asthmatic conditions appears to be six weeks to two months, during which the daily inhalations should be taken very regularly and every effort made that their continuity is not broken.

In pneumonia, inhalations are usually continued during the convalescent stage in a modified form in the absence of indications to the contrary.

Indications of treatment, representing inhalations prescribed, are set out under their various headings.



## VII

### ASTHMA

ASTHMATICS speak of this treatment with enthusiasm compared with the usual forms of therapy, which is probably due as much to their improvement in general health and spirits as to the absence or diminution of attacks.

The inhalation of adrenalin will stop or avert the attack, and when it is supported by a carefully prescribed course of curative treatment the paroxysms diminish in frequency and the asthmatic habit becomes broken and the tendency to further attacks definitely reduced.

As a general rule, two regular treatments of fifteen minutes' duration are prescribed to be taken morning and evening. Their object is twofold, viz. to restore the lungs to a normal condition, and during the process to keep the asthma quiescent.

To achieve the former, such preparations as Campheugene (camphor 16· guaiacol 8· menthol 6·) or creosote are employed, and an adequate dose is represented by an inhalation of about twenty to twenty-five minutes daily. Better results appear to be obtained when two, three or four short inhalations are taken during the day instead of one long inhalation.

The Campheugene preparation is most prescribed, as it contains camphor, menthol and guaiacol, and in emphysematic conditions camphor is often definitely indicated, on account of its stimulating action on the breathing. If difficulty is experienced in inhaling, it may be diluted with pine or cajuput oil. Pine oil sometimes causes dyspnœa, which has not been observed when cajuput oil is employed.

To stop or abort an attack, adrenalin is employed. When inhaled by this method, it frequently causes irritation of the mucous membrane, and to avoid this the Apneugene preparation is prescribed, as it contains 1 per cent. anæsthesin in adrenalin 1/1000.

To keep the asthma quiescent, it is usual to include one or more inhalations of the Apneugene preparation in the daily treatment of Campheugene, etc., as set out on pp. 39—40, and which may start with five minutes' inhalation of adrenalin preparation, three minutes' rest, then another five minutes with whatever inhalant has been prescribed of a curative nature. Then another short interval, followed by five minutes of the curative inhalant only, and if the patient finds comfort in it, a final inhalation of the adrenalin preparation only.

Apart from the inclusion of adrenalin in the daily treatment, additional or extra inhalations will probably be necessary at the beginning of treatment to avert or stop an attack. The inhaler is placed at the bedside if the patient is liable to have an attack during the hours of the night. For this purpose an inhalation is of the utmost

value, as by aborting the attack the patient is able to regain sleep.

In most cases the asthma diminishes as soon as the inhalations have been started, and becomes quiescent after a short period, and the extra and additional adrenalin inhalations between times of daily treatment are no longer necessary. This may or may not indicate that it may be stopped in the daily treatment, and the inhalation of Campheugene or creosote only continued to remove pathological conditions. As a general rule, the inclusion of it is continued for a reasonable period at this stage.

There have been very severe cases of asthma and similar conditions accompanied by an excessive accumulation of sputum and severe dyspnoea, when as long a period as six weeks has gone by before any kind of relief has been apparent, but by the persistent inhalation of the inhalants prescribed their action has eventually been sufficient to change these conditions, and recovery or amelioration has been established.

Instances of this nature which have come under the observation of the writer have been long-standing cases of asthma of ten and fifteen years, which were regarded as more or less hopeless, the patients being definitely in a "status asthmaticus."

On the other hand, there are many instances under similar conditions when recovery has been remarkably rapid. The patients have been able to sleep at night after a week's treatment, and the seizures have rapidly

become less and less frequent and complete freedom been secured.

It appears to be quite impossible to foretell how much treatment may be required in these conditions and when relief will be obtained, but results in asthma cases of this nature definitely encourage one to try a course of inhalations, even for six weeks or more, without any visible signs of improvement, where other methods have failed.

Occasionally adrenalin only will fail to give relief, in which case it can be substituted by a preparation with the addition of atropine.

Ephedrine does not appear to give the good results by inhalation that it does in tablet form. It may, however, be used with advantage when adrenalin cannot be tolerated, but most ephedrine preparations are made up with it, and for this reason such inhalants as Ephedol, which do not contain adrenalin, may be tried.

Children usually require longer treatment than adults before they respond. Very excellent results have been observed in asthma.

With adults, it is the older patients that frequently respond more quickly, and some of the dramatic recoveries that have been observed have been in patients over sixty and seventy years of age.

High blood pressure, as a general rule, does not appear to be a contra-indication to the use of adrenalin by inhalation, and it is extensively prescribed in these conditions, and especially with a camphor inhalant.

The amount absorbed is small, and on this account it would appear that short inhalations may be safely employed and repeated.

The duration of treatment in ordinary cases of asthma is about two months, and results tend to show that any less period is insufficient to establish an improved state of health and freedom from relapse.

The addition of  $\text{CO}_2$  to oxygen has been prescribed for asthma and used with the inhaler and atomised liquids, but the results do not appear to have been impressive, and its use has not in any way become general at present.

The addition of camphor to the oxygen definitely stimulates the breathing, and the increased action of the lungs may be observed by the movements of the bag attached to the inhaler, which increase correspondingly. This use of camphor with oxygen instead of  $\text{CO}_2$  is general, and patients seldom find difficulty in tolerating it.

During a course of treatment physicians often recommend barley water before each meal, and a quart to be taken daily, and also an avoidance of sugar and sugar-content in food.

Although treatment would appear to be clearly more suitable for bronchial asthma than for other types, its employment is not confined to these conditions. Allergic types respond to treatment, and also nervous types, the inhaler itself, perhaps, having a psychological value in the latter.

Hay asthma and similar conditions are also treated.

Amelioration can usually be afforded, and in many cases patients are rendered immune for the season after a few weeks' treatment.

## INDICATIONS OF TREATMENT

### ASTHMA ATTACK

A special inhalation prescribed to stop an asthma attack is regarded as an extra inhalation in addition to the regular treatment which is taken daily.

No. 1.	Inhale Apneugene <sup>1</sup>	.	.	.	.	5 minutes
	Rest 3 minutes.					
	Inhale Apneugene	.	.	.	.	5 minutes
						<hr/>
	Total inhalation	.	.	.	.	10 minutes
						<hr/>

No. 2.	Inhale Apneugene	.	.	.	.	4 minutes
	Rest 3 minutes.					
	Inhale Apneugene and Campheugene <sup>2</sup>	.				4 minutes
	Rest 3 minutes.					
	Inhale Apneugene	.	.	.	.	3 minutes
	Rest 3 minutes.					
	Inhale Apneugene and Campheugene	.				4 minutes
	Rest 10 minutes.					
						<hr/>
	Total inhalation	.	.	.	.	15 minutes
						<hr/>

<sup>1</sup> Contents : Adrenalin Synthetic Preparation 1/1,000. 1% Anæsthesin.

<sup>2</sup> Contents : Camphor 16', Menthol 8', Guaiacol 6'.

## REGULAR DAILY TREATMENT FOR ASTHMA

No. 3.	Inhale Apneugene . . . . .	4 minutes
	Rest 3 minutes.	
	Inhale Apneugene and Campheugene (both phials nebulising) . . . . .	4 minutes
	Rest 3 minutes	
	Inhale Campheugene only . . . . .	4 minutes
	Rest 3 minutes.	
	Inhale Apneugene . . . . .	3 minutes
	Rest 10 minutes.	
	<hr/>	
	TWICE DAILY . . . . .	<u>15 minutes</u>
	<hr/>	
No. 4.	Inhale Apneugene . . . . .	5 minutes
	Rest 3 minutes.	
	Inhale Apneugene and Creosote . . . . .	5 minutes
	Rest 3 minutes.	
	Inhale creosote . . . . .	5 minutes
	Rest 10 minutes.	
	<hr/>	
	TWICE DAILY . . . . .	<u>15 minutes</u>
	<hr/>	
No. 5.	Inhale Apneugene only . . . . .	2 minutes
	Rest 3 minutes.	
	Inhale Apneugene with Iodine <sup>1</sup> . . . . .	5 minutes
	Rest 3 minutes.	
	Inhale Apneugene with Iodine . . . . .	4 minutes
	Rest 3 minutes.	
	Inhale Apneugene and Campheugene . . . . .	<u>4 minutes</u>
	<hr/>	
	TWICE DAILY . . . . .	<u>15 minutes</u>
	<hr/>	

<sup>1</sup> Contents : Adrenalin Synthetic Preparation 1/1,000. Anæsthesin 1%, Iodine 1%, Potass. Iodide 8.5%.

## VIII

### BRONCHITIS AND EMPHYSEMA

THE treatment for these conditions is much the same as that for asthma. In almost all cases the inhalations give relief and comfort to the patient. Their breathing becomes easier, the congestion is reduced and expectoration is rendered less difficult, and a more restful state induced, and better sleep.

Treatment usually consists of inhalations of the Apneugene preparation, and the Campheugene preparation diluted with pine oil or cajuput oil. Adrenalin and iodine inhalations are also prescribed. Short inhalations are usually taken every two or three hours.

The inhalations appear to arrest the progress of the disease and strengthen the mucous membrane to resist new infection, which so frequently leads to a state of relapse and chronic illness.

Congestion is reduced by the use of the adrenalin and the breathing stimulated and the circulation improved by the employment of camphor.

The superficial breathing which is generally present gives way to deeper and more effectual inspirations, and ventilates those parts of the lungs in which an abnormal amount of residual air has collected.



According to Zuelzer, the adrenalin checks the secretion, and Storm van Leeuwen advised its use in elderly patients suffering from bronchitis.

It is usual to find the heart affected. Digitalis is often disappointing in its action, and there would appear to be no doubt that better and more certain results can be looked for from inhalations of camphor and adrenalin. When given in such small quantities, represented by a short inhalation, they can be frequently repeated, and produce a more regular and steady action.

The gradually improved state of the lungs and the rest accorded the patient on this account brings about more peaceful sleep, which can reasonably be expected soon after treatment has begun.

After recovery, those suffering from emphysema usually find that their improved state of health cannot be maintained without a short inhalation daily. This usually consists of five minutes of Apneugene and five minutes of Campheugene taken in the latter part of the day. This has been the means of restoring to many invalids, or partial invalids, a great measure of health, so that they have been able, more or less, to lead normal lives again, and to attend to their social or business duties.

In the same way, patients who have suffered from chronic bronchitis find that they can avoid much illness in the future by taking a few inhalations at once upon

any signs of the symptoms re-appearing. Very few inhalations at this early stage are necessary to ward off a relapse and establish normal conditions again.

## INDICATIONS OF TREATMENT

No. 6.	Inhale Apneugene . . . . .	3 minutes
	Rest 3 minutes.	
	Inhale Campheugene . . . . .	5 minutes
	Rest 3 minutes.	
	Inhale Apneugene . . . . .	3 minutes
	Rest 10 minutes.	
	Total inhalation . . . . .	<u>11 minutes</u>
		<u><u>          </u></u>

INHALED THREE OR FOUR TIMES A DAY

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No. 7.	Inhale Apneugene . . . . .	3 minutes
	Rest 3 minutes.	
	Inhale Campheugene . . . . .	4 minutes
	Rest 3 minutes.	
	Inhale Apneugene and Campheugene . . . . .	4 minutes
	(If Campheugene is too strong dilute with Cajuput Oil).	
	Total inhalation . . . . .	<u>11 minutes</u>
		<u><u>          </u></u>

INHALED THREE OR FOUR TIMES A DAY

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# INHALATION THERAPY TECHNIQUE

No. 8.	Inhale Apneugene . . . .	3 minutes
	Rest 3 minutes.	
	Inhale Transpulmin <sup>1</sup> . . . .	3 minutes
	Rest 3 minutes.	
	Inhale Transpulmin . . . .	3 minutes
	Rest 3 minutes.	
	Inhale Campeugene . . . .	3 minutes
	Rest 3 minutes.	
	Inhale Pine or Cajuput Oil . . . .	3 minutes
	Rest 10 minutes.	
	Total inhalation . . . .	<u>15 minutes</u>

## INHALED TWICE DAILY

No. 9.	Inhale Apneugene . . . .	3 minutes
	Rest 3 minutes.	
	Inhale Apneugene . . . .	3 minutes
	Rest 3 minutes.	
	Inhale Apneugene . . . .	3 minutes
	Rest 3 minutes.	
	Inhale Cajuput Oil . . . .	3 minutes
	Rest 3 minutes.	
	Inhale Cajuput Oil . . . .	3 minutes
	Rest 10 minutes.	
	Total inhalation . . . .	<u>15</u>

## TWICE DAILY

<sup>1</sup> Contains 0.03 gm. chin. bas. anhydr. and 0.025 gm. camphor in ether oils.

## IX

### PNEUMONIA

WHEN oxygen is being administered the practice of placing the mask on the bedclothes beneath the chin of the patient and occasionally the nurse holding it to the mouth is useless. Any oxygen that may reach the lungs from time to time would be totally inadequate for any therapeutic purpose whatsoever.

The greatest care has to be taken to assure the mask fitting the contours of the face, and in pneumonia a rubber pad is recommended, which is made to attach to the rim.

Frequently the patient is unable to hold it in position and it should be supported in front of the nose and mouth by a piece of elastic passing round the mask and the head. The rubber pad is then definitely necessary, to avoid the edges of the mask unduly pressing against the face.

To make certain that the oxygen is being inhaled, observation should be made that the bag between the mask and the inhaler shows some signs of deflation at each intake of breath, as described on page 25.

The amount of oxygen in the cylinder, which is shown on the dial, should be watched, which will read "FULL,"

“HALF FULL,” “QUARTER FULL,” as the case may be. A red flag appears on the dial when half the oxygen has been used. Additional cylinders should always be ordered well in advance of possible contingencies.

The treatment prescribed, as a general rule, is five minutes' inhalation of Apneugene followed by five minutes of Campheugene, which may be diluted with cajuput if necessary. The inhalations as a general rule are repeated every hour, according to the condition of the patient.

If oxygen is prescribed during the interval, it can be administered without removing the face mask (or phials on the inhaler), by rotating the handle to indicate “OXYGEN ONLY.”

Some physicians recommend inhalations upon the first signs of cyanosis, and others more or less continuously from the commencement of illness.

As has been described in current literature on the subject, the fact that cyanosis may appear early without any marked respiratory indications suggests pathological conditions of the alveolar epithelium due to toxins, and some physicians prescribe inhalations before cyanosis has occurred, at the beginning of illness.

Whichever period is chosen, however, the proper inhalation of the oxygen and the inhalants in such a way as to ensure them reaching the finer bronchi and alveoli is a prime factor, which is sometimes not realised by those carrying out the instructions of the physician.

Treatment has been employed and started in all stages of the illness, and the results appear to indicate that it

is a safer course, as a general rule, to start treatment early rather than late, and at the beginning of the illness, before the patient has become weak.

The warming of oxygen and vapour does not appear to give additional value, but whether this is so or not, its temperature after passing through the storage bag on its way to the mask is raised and the initial chill reduced or removed, which often exists in cold weather when the cylinders have been stored in a cold place.

## INDICATIONS OF TREATMENT

No. 11. Inhale Apneugene <sup>1</sup>	. . .	3 to 5 minutes
Rest	3 minutes.	
Inhale Campheugene <sup>2</sup>	. . .	4 minutes
Rest	4 minutes.	
Inhale Apneugene and Campheugene (both phials nebulising)	. . .	3 minutes
Total inhalation	. . .	<u>10 to 12 minutes</u>
Inhaled every 1 to 3 hours		

No. 12. Inhale Apneugene	. . .	5 minutes
Rest	3 minutes.	
Inhale Transpulmin <sup>3</sup>	. . .	5 minutes
Rest.		
Total inhalation	. . .	<u>10 minutes</u>
Inhaled every 1 to 3 hours		

<sup>1</sup> Contents : Adrenalin Synthetic Preparation 1/1,000. 1% Anæsthesin.

<sup>2</sup> Contents : Camphor 16, Menthol 8, Guaiacol 6.

<sup>3</sup> Contents : 0.03 gm : chin. bas. anhydr. and 0.025 gm. camphor in ether oils.

## X

### BRONCHIECTASIS

INHALATIONS are prescribed on account of their therapeutic and antiseptic value. The breath of the patient rapidly changes.

Creosote is generally prescribed, either by itself or with adrenalin, Pine oil, or any other inhalant which is indicated.

The preparations are brought into direct contact with the pathological area, and their action is accelerated when the patient is able to have three or four short treatments daily instead of one or two of longer duration.

### INDICATIONS OF TREATMENT

No. 10. Inhale Creosote . . . . .	5 minutes
Rest 3 minutes.	
Inhale Creosote . . . . .	5 minutes
Rest 3 minutes.	
Inhale Creosote . . . . .	5 minutes
Rest 10 minutes.	
Total inhalation . . . . .	<u>15 minutes</u>

TO BE INHALED TWICE DAILY

## XI

### TUBERCULOSIS

As a general rule, air is used to nebulise the inhalants, and not oxygen.

“It is being employed in cases of pulmonary tuberculosis complicated by asthma, in the mixed infection bronchitis in tubercle for loosening phlegm, draining bronchi and emptying cavities ; for relieving nocturnal cough and promoting sleep ; after cases of spontaneous pneumothorax to dilate the bronchi and allow the phlegm to escape from the compressing lung ; in cases with acute laryngitis ; after severe hæmoptysis to clear the lung and prevent the inspiratory bronchitis so often occurring. Patients of all ages can take the treatment, but children tolerate larger doses.”

“Inhalations quickly relieve the broncho-spasm in cases of tuberculosis complicated by asthma. In cases of shock after induction of artificial pneumothorax, the adrenalin inhalations have aborted the symptoms. The life of a left-sided artificial pneumothorax case, who developed a spontaneous pneumothorax on the right side and was dying from acute asphyxiation, was saved by this apparatus, as it kept her bronchi open until an aspiration could be performed. Since using the apparatus,



patients with advanced tuberculosis do not seem to have developed laryngeal tuberculosis. This may be a coincidence, or may be due to the disinfectant and cleaning action of the drugs inhaled.”<sup>1</sup>

The inhalants employed are adrenalin, camphor, creosote and other preparations, but in practice they will be limited to a few which give the necessary results. The cough, in cases of tuberculosis laryngitis, has been relieved and patients have been able to sleep quietly and undisturbed by taking an inhalation at bedtime for ten minutes.

The employment of inhalations in pulmonary tuberculosis has been more or less confined to those cases with mixed infection, and there have been cases when it would appear that the progress of the disease has been arrested. Whether this is so or not, it has been repeatedly stated that whenever a remedy has been found it will be administered by this method.

## INDICATIONS OF TREATMENT

### PULMONARY TUBERCULOSIS WITH MIXED INFECTION

The inhalations which are prescribed in cases of mixed infection when asthma or other conditions are present are similar to those prescribed in the ordinary way except that air is usually employed to vaporise the inhalants instead of oxygen.

<sup>1</sup> Extract from the Annual Report of the Central Tuberculosis Officer of the Lancashire County Council for 1933.

A typical prescription in the absence of such conditions provides for an inhalation of fifteen minutes' duration, and broken up into three or five short inhalations of five or three minutes each with three minutes' rest in between.

A camphor preparation is frequently employed, and also creosote and thymol, depending upon the conditions for which they are required, atomised with air.

No. 13. Inhale Campheugene . . . . .	3 minutes
Rest 3 minutes.	
Inhale Campheugene . . . . .	3 minutes
Rest 3 minutes.	
Inhale Campheugene . . . . .	3 minutes
Rest 3 minutes.	
Inhale Pine Oil . . . . .	3 minutes
Rest 3 minutes.	
Inhale Pine Oil . . . . .	3 minutes
Rest 10 minutes.	
Total inhalation . . . . .	<u>15 minutes</u>

INHALED TWICE DAILY

No. 14. Inhale Creosote and Pine Oil . . . . .	5 minutes
Rest 3 minutes.	
Inhale Creosote . . . . .	5 minutes
Rest 3 minutes.	
Inhale Creosote and Pine Oil . . . . .	5 minutes
Rest 10 minutes.	
Total inhalation . . . . .	<u>15 minutes</u>

INHALED TWICE DAILY

## T.B. LARYNGITIS

No. 15. Inhale Thymol . . . . .	5 minutes
Rest 3 minutes.	
Inhale Thymol . . . . .	5 minutes
Rest 3 minutes.	
Inhale Thymol and Pine Oil . . . . .	5 minutes
Rest 10 minutes.	
Total inhalation . . . . .	<u>15 minutes</u>

## INHALED TWICE DAILY

No. 16. To stop cough.	
Inhale Thymol . . . . .	5 minutes
Rest 3 minutes.	
Inhale Thymol . . . . .	5 minutes
Rest 3 minutes.	
Total inhalation . . . . .	<u>10 minutes</u>

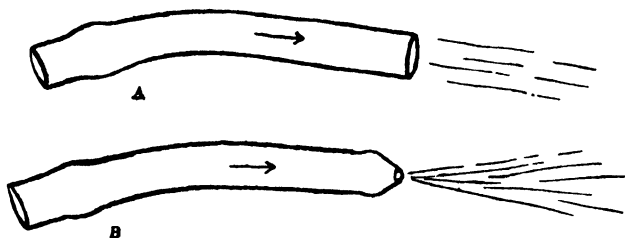
## INHALE AT BEDTIME

## XII

### UPPER AIR PASSAGES

IN treating the upper air passages, two distinct methods are employed, one for local application upon a given surface, and another for general introduction of the inhalant to the upper air passages and sinuses.

If the former method is employed, a nose-piece is used with the outlet for the vapour restricted, as in Fig. B.



The effect of this restriction is to increase the rate of flow in proportion to the smallness of the outlet, and by reducing it sufficiently the increased speed of the vapour particles causes them to be deposited at point of contact, and a high proportion of inhalant will thus be applied on that particular surface.

If a general introduction is intended, the nose-piece should be constructed with a generous outlet, as shown

in Fig. A. The rate of flow is then not increased, as it is by the former method, and the particles of vapour will be carried in the air or oxygen to the entire upper air passages.

As a general rule an introductory inhalation of adrenalin is administered for ten minutes, which is followed by whichever inhalant it is desired to employ. For the common cold, Camphene and pine oil in equal parts are used in the white phial, and adrenalin in the amber one, and a treatment of this nature will usually clear things up if taken in time. If the cold has been allowed to develop, treatment is continued for a day or two.

Similar treatment will clear up a relaxed throat and the hoarseness which attacks singers and public speakers, and is particularly valuable where a quick recovery is important. The camphor and oxygen is valuable, as it appears to clear up the headache and similar symptoms which accompany these conditions. Indications of treatment are set out on pp. 55—56.

Single and double nasal pieces are both employed, but they should have no obstructed ends when intended for general nasal application.

When treating the sinuses a single nasal piece, as shown in Fig. A, is usually employed, with a generous flow of oxygen and vapour, and beginning with an adrenalin inhalant.

This method is employed for the purpose of draining sinuses, which has avoided operations that are sometimes otherwise indicated.

If treatment through the eustachian tubes is wanted, the patient can inhale the vapour up the nostrils till he feels it in the back of the nose and throat. He then pinches his nostrils and blows down his nose as if using a pocket handkerchief. The vapour should then find its way up the eustachian tubes and “crack the ears” open. This is effected only with difficulty at first as a little practice is generally required, and, in addition, the tubes are abnormally narrow in the appropriate cases.

## INDICATIONS OF TREATMENT

### NASAL CATARRH

No. 17. Inhale Apneugene . . . .	4 minutes
Rest 3 minutes.	
Inhale Apneugene . . . .	4 minutes
Rest 3 minutes.	
Inhale Campheugene and Pine Oil . .	4 minutes
Rest 3 minutes.	
Inhale Campheugene and Pine Oil . .	3 minutes
Rest 10 minutes.	
Total inhalation . . . .	<u>15 minutes</u>

To be inhaled through the nose and exhaled through the mouth.  
A double nasal-piece may be used.

TWICE DAILY

## 56      INHALATION THERAPY TECHNIQUE

### NASAL CATARRH—*continued.*

No. 18. Inhale Mucidan <sup>1</sup> . . . . .	5 minutes
Rest 3 minutes.	
Inhale Camphene . . . . .	3 minutes
Rest 3 minutes.	
Inhale Camphene . . . . .	3 minutes
Rest 3 minutes.	
Inhale Pine Oil . . . . .	4 minutes
Rest 10 minutes.	
Total inhalation . . . . .	<u>15 minutes</u>

To be inhaled through the nose and exhaled through the mouth.

TWICE DAILY

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### STRAINED VOICE

No. 19. Inhale Pine Oil . . . . .	5 minutes
Rest 3 minutes.	
Inhale Chlorotone . . . . .	2 minutes
Rest 3 minutes.	
Inhale Chlorotone . . . . .	3 minutes
Rest 3 minutes.	
Inhale Pine Oil . . . . .	5 minutes
Rest 10 minutes.	
Total inhalation . . . . .	<u>15 minutes</u>

To be inhaled and exhaled through mouth.

TWICE DAILY

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<sup>1</sup> Contains those salts of rhodanic (sulphocyanic) acid, which possess the strongest liquefying action on mucus and are absolutely non-poisonous.

## HAY FEVER

No. 20. Inhale Glycirenane (through the nose)	.	2 minutes
Rest 3 minutes.		
Inhale Gencydo (through the nose)	.	3 minutes
Rest 3 minutes.		
Inhale Gencydo (through the nose)	.	3 minutes
Rest 10 minutes.		
Inhale Gencydo (through the mouth)	.	6 minutes
Rest 3 minutes.		
Inhale Gencydo (through the mouth)	.	6 minutes
Rest 3 minutes.		
Inhale Gencydo (through the mouth)	.	6 minutes
Rest 10 minutes.		
Total inhalation	.	<u>26 minutes</u>

## TWICE DAILY

## WHOOPING COUGH

No. 21. Inhale Cypress Oil	.	3 to 5 minutes
Rest 3 minutes.		
Inhale Cypress Oil	.	3 to 5 minutes
Rest 10 minutes.		
Total inhalation	.	<u>6 to 10 minutes</u>

REPEAT EVERY THREE HOURS, OR WHEN ATTACK THREATENS



## AUTHOR'S NOTE

### OXYGEN AND CO<sup>2</sup>

I should like to add to the remarks on pages 7 and 38, that as a general rule the addition of CO<sup>2</sup> to oxygen stimulates the breathing to a greater extent than the addition of camphor to pure oxygen. This, however, is not always the case, and occasionally this is reversed, the breathing being more stimulated by the inhalation of oxygen with a camphor inhalant.

## **ADDENDA**



*Extract from the British Medical Journal, February 2nd,*  
1935

## INHALATION APPARATUS

Dr. A. H. Douthwaite (London, W.) writes :—

The treatment of such conditions as asthma, chronic bronchitis, tuberculosis and bronchiectasis by inhalation of certain drugs has gained much popularity of recent years. The introduction of the Collison inhaler has overcome the impracticability of patients taking a proper course of treatment at home without any irksome or tiresome features usually associated with medical apparatus. It is simple for them to understand, and meets the requirements of modern medicine. It was first exhibited at the British Medical Association Exhibition in 1932.

Mounted on an oxygen cylinder, it is provided with two glass phials, which are easily and quickly detachable, for such inhalants as adrenaline in one and camphor or creosote in the other. They are vaporised with oxygen, which is inhaled with the atomised drugs. One or other of the liquids can be nebulised separately or both together at the same time by rotating the top handle, or oxygen only can be employed by itself. The vapour reaches the entire bronchial tree, including the finer bronchi and alveoli, and is dense enough to be effective. It is stored

in the bag for this purpose, and can be regulated to suit requirements by the lower handle.

The face mask is fitted with two valves, one for inhaling from the bag and one for exhalation. There is an indicator showing the pressure in the cylinder, marked "Full—Three-quarter full—Half full—Quarter full—Empty." A red signal shows when half has been used.

The inhaler may be hired or purchased from the makers : The Inhaling Drug and Apparatus Co. Ltd., 87 Eccleston Square, S.W.1.

*Extract from "The Treatment of Asthma," by Dr. A. H. Douthwaite*

*Chapter IX., "Modern Methods"*

"OF recent years various forms of inhalation apparatus<sup>1</sup> have been devised to supply the asthmatic with anti-spasmodic drugs in a state of fine division. Oxygen is passed through a solution of the chosen medicament, which is then reduced to a vapour of remarkable tenuity. Inhalation of vapourised adrenalin and stramonium brings an attack to a standstill almost immediately, and aborts a threatening seizure.

The great advantage which this possesses over such preparations as asthma powders and cigarettes is that there is nothing irritating in the inhaled material. The use of oxygen as a vehicle is far more efficacious than that of compressed air, owing perhaps to the relief of the

<sup>1</sup> Of these, the Apneu apparatus is the best.

excessive oxygen unsaturation of the blood which we have observed to exist in the asthmatic attack. Diminution of the excitability of the respiratory centre is thus induced.

Camps (35) in a recent article on the subject has stressed the unquestionable relief obtained by chronic sufferers, an opinion with which the author fully concurs.

One has been greatly impressed by the enthusiasm with which chronic asthmatics speak of this treatment as compared with all the usual forms of therapy. Not only do they find that attacks may be aborted by its use, but also they notice a decided diminution in the frequency of paroxysms.

The patient must have the apparatus by the bedside for immediate use when an attack threatens. By regular employment of inhalation therapy, the asthmatic habit is broken and the tendency to further attacks is definitely reduced.

This form of treatment is particularly valuable for chronic asthmatics with bronchitis and emphysema, for which conditions creosote vapour should be inhaled twice daily on occasions when the asthma is quiescent. Should a paroxysm occur, adrenalin must be promptly substituted.

### *Chapter XI., "Treatment of Complications"*

*Bronchitis.* Of greater efficacy in the treatment of chronic bronchitis are certain forms of inhalation. Good

<sup>35</sup> Camps, P. W. L.: *Guy's Hospital Reports*, 1929, 79, 496.

results cannot be expected from the application of a mask soaked in medicament to the patient's face. A reliable nebuliser using oxygen as the basis is demanded. With such apparatus, creosote, pine oil, eucalyptus oil and adrenalin can be converted into the finest vapour and inhaled into the lowest reaches of the respiratory tract without embarrassment.

*Emphysema.* As emphysema resulting from asthma is almost always combined with bronchitis, much of that which has already been written applies with equal force here."

## INHALATION THERAPY IN PULMONARY TUBERCULOSIS

BY THE APNEU COLLISON INHALER

By G. BARKER CHARNOCK, L.R.C.P., L.R.C.S., D.P.H.,  
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*Lancashire*

OF the many ways by which drugs can be introduced into the body, perhaps that by way of the air passages has received least attention until recently.

By inhalation therapy is meant treatment by inhaling drugs into the respiratory tract, which includes the nose, pharynx, larynx, trachea, bronchi and the alveoli of the lung. Formerly inhalation was confined to volatile substances possessing curative or soothing properties,

whereas to-day the scope of this therapy can be extended to a large number of chemical medicines, both oily and fluid in consistency.

At a first glance there does not seem to be anything very new in this method. The breathing of moist airs or vapours impregnated with soothing balsams has been a time-honoured method for the alleviation of acute catarrhal infections of the respiratory passages. The smelling bottle in syncopal attacks, the old bronchitis kettle, and the steam tent for croup, the use of such volatile substances as ether and chloroform, to mention only a few examples, are familiar to everyone and are in common use.

Having been successful so far with volatile substances and with gases like oxygen and carbon dioxide, which are, of course, easily inhaled, search was conducted with a view to determining whether or not it were possible to convert some of the denser substances, *e.g.*, oils and fluids, into a vapour form. Then came the sprays, atomisers and nebulisers, for blowing liquids and oils into a fine state of division, and the insufflators for propelling solids in a finely triturated condition into the air passages. All the foregoing measures were successful as far as they went, but on examining the results of the oils it was found that owing to their molecular weight they tended to fall rapidly on the mucous membranes of the air passages, and consequently did not penetrate very far into the ramifications of the lungs. It had long been known as a physical and chemical fact that elements and



compounds, when in the finest state of division possible, gave quicker and more satisfactory chemical reactions. Hence the idea of fine subdivision of the particles had a twofold use ; on the one hand to get deeper into the air passages, and on the other to obtain as quick and as potent an action as possible of the drugs on the surfaces of the lungs. As the alveolar surfaces of the lungs are estimated to be at least forty times greater in area than the exterior surfaces of the body, it would seem that if drugs having the fore-mentioned properties could be deposited thereon some benefit might accrue. It was found that drugs could be so deposited and absorbed. It was also established that local treatment to the respiratory passages could best be given by applying drugs which were not absorbed too rapidly. On this account oily substances were often found preferable. Experiments on animals have shown that if the drugs can be atomised sufficiently finely they can be made to reach the alveoli. For instance, in the case of camphor it is found that it can be absorbed by the blood and excreted in the breath, like garlic. The lungs like to absorb substances of the least density, the less dense the better they are taken into the pulmonary tissues. The hand-sprays dispense oils and fluids in a fine state of division, but when the particles are inhaled they travel only a comparatively short distance along the air passages, probably only as far as the larynx or, at most, the trachea. These atomisers are very helpful for nasal, pharyngeal, laryngeal, and tracheal catarrhs, but will exert little or no effect on

bronchitis. Constant use is made of these daily in the sanatorium. They may, however, prove troublesome, since the drugs become deposited in the pharynx and may be swallowed, causing digestive troubles. To obtain the best results the particles must be fine and dense. Even then only 20 to 30 per cent. of the nebulised drug reaches the termini of the bronchi. It was thought that if it were possible to obtain a direct action in the lung it might in some degree act as a useful adjuvant to sanatorium treatment.

With a view to ascertaining the effect of inhalation treatment in pulmonary tuberculosis, a nebulising apparatus called the Apneu (Speiss-Dräger) Inhaling Apparatus was hired. This apparatus is mounted on a 40 cubic foot compressed air cylinder. The air, controlled as in an oxygen cylinder, is forced through two phials, one of which is amber in colour and is used to contain the photo-synthetic drugs like adrenalin, the other a white phial of clear glass accommodates other drugs, either oils or fluids. The compressed air may be forced through each separately or both simultaneously by a special arrangement of valves. The quantity of air in the cylinder, and the rate at which it is passing out of the cylinder are registered on two manometers. Each phial contains an atomiser which dips into the fluid in the conical bottom for a short distance. The vapour thus created passes along into a mixing and depositing chamber, almost like a motor carburetter, thence along to the valved face mask which fits comfortably over the patient's mouth and nose.

This apparatus was very satisfactory and much appreciated by the patients. Encouraged by this appliance, an English model much on the same lines but more compact and convenient in size, easier to control and more fool-proof, was obtained. The phials are smaller and more easily detached for refilling and cleaning. This model, described as the Apneu Collison Inhaler, is mounted as previously described. It has one manometer only, showing the pressure in atmospheres in the cylinder. A single valve dispenses the compressed air in weak, medium, or strong power. A second valve controls the phials, singly or simultaneously or allows plain air alone to pass to the mask as required. The 40 cubic foot cylinder is convenient for lifting, and when placed in a cylinder trolley can easily be moved to and from the bedside.

As the fineness of the particles is determined by the strength of pressure, the greater the pressure the finer the particles. A full cylinder gives better results than one that has been in use for some time. The particles have been measured and found to be as small as  $1/5,000$ th of an inch, whereas those from the best handsprays are computed to measure about  $1/50$ th of an inch. The inhalations can be given warm or cold, in large or small doses. The routine has been to prescribe adrenalin put up in the form of adrenalin synthetic  $1/1,000$  and 1 per cent. anæsthesin. The latter is included to relieve the irritating effect of adrenalin. This nebulised drug may be given weak, medium, or strong, according to the needs of the

patient, the medium strength usually sufficing. This is continued for three minutes, followed by a rest of three minutes. The valve is then switched over to the other phial which may contain many kinds of oils, *e.g.*, camphor, pine, cypress, cajuput, thymol, menthol, or creosote, etc. Adrenalin dilates the bronchial tubes and reduces congestion. It has been said of it that acting on any part it has the same effect as stimulation of the sympathetic nerve to the part. For this reason it is by far the most effective treatment in an allergic crisis, for it both neutralises histamine in an allergic crisis, as well as stimulates the sympathetic, that is, the inhibitory nerve to plain muscles such as those of the uterus, intestines and bronchi. Camphor stimulates the breathing centres and blood circulation. Pine, cajuput, and cypress are very soothing to the inflamed mucous membrane. Thymol and menthol are antiseptic and cleaning, and creosote is a disinfectant. Iodine, ordinarily very irritating, can be given easily in such fine division.

The treatment, which is given when necessary, has been found soothing to the patient, quite safe, and very efficient. It relieves distress from asthma, bronchitis, laryngitis, pneumonia, and other pathological conditions associated with pulmonary tuberculosis. It has been used regularly at Elswick Sanatorium in cases of pulmonary tuberculosis complicated by asthma, in the mixed infection bronchitis in tubercle for loosening phlegm, draining bronchi and emptying cavities ; for relieving nocturnal cough and promoting sleep ; after cases of spontaneous pneumo-

thorax to dilate the bronchi and allow the phlegm to escape from the compressing lung ; in cases with acute laryngitis ; after severe hæmoptysis to clear the lung and prevent the inspiratory bronchitis so often occurring. Patients of all ages can take the treatment, but children tolerate larger doses.

Inhalations quickly relieve the broncho-spasm in cases of tuberculosis complicated by asthma. In cases of shock after induction of artificial pneumothorax the adrenalin inhalations have aborted the symptoms. The life of a left-sided artificial pneumothorax case, who developed a spontaneous pneumothorax on the right side and was dying from acute asphyxiation, was saved by this apparatus, as it kept her bronchi open until an aspiration could be performed. Since using the apparatus, patients with advanced tuberculosis do not seem to have developed laryngeal tuberculosis. This may be a coincidence, or may be due to the disinfectant and cleaning action of the drugs inhaled.

A typical prescription may be given as follows :—

#### INHALATION PRESCRIPTION

	INHALANT.	TIME (Mins.).	
		Inhale.	Rest.
(1)	Adrenalin . . .	3	
(2)	Rest . . .		3
(3)	Camphor . . .	3	
(4)	Rest . . .		3
(5)	Adrenalin . . .	3	

From this it will be seen that, at the shortest, about fifteen minutes is necessary to obtain relief, and the patient may require two of these in the day or night. Particularly is the treatment indicated at night when patients are usually more uncomfortable. There is a wide range of drugs from which to choose a suitable medicine, but in practice these will eventually be limited to a few which give the necessary results.

Inhalation therapy by this method was found in practice to entail an extra amount of time and labour on the part of a number of the staff, nursing, clerical and outdoor. The constant ordering, exchanging, forwarding, delivering and returning cylinders was expensive. Means were sought to overcome some of these difficulties. Experiments were made with electric pumps and old cylinders, and as a result 40 cubic foot cylinders can now be charged with compressed air in the wards by the nurse in charge of the case. This means that good pressure can be maintained, assuring a satisfactory nebulisation, and that the treatment becomes very much cheaper.

We are indebted to Major W. E. Collison for his courtesy and help in connection with this treatment.

*Extracted from article in The Practitioner, May, 1932, Vol. cxxviii., pp. 511-513.*

## THE TREATMENT OF PNEUMONIA

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*Cyanosis* in pneumonia denotes a lack of oxygen in the blood ; this has been abundantly proved by analyses of venous and arterial blood (5, 6). This lack is due to the inability of oxygen to reach the blood in sufficient concentration, and not to inability of the blood to take up oxygen. The fact that cyanosis may appear early in the disease, without any marked obstruction of respiratory passages or of respiratory movements, and before the appearance of any appreciable consolidation, suggests that the alveolar epithelium is damaged by toxins as regards its respiratory function. To the cyanosis which occurs later there are many contributing factors, such as previous damage to the lungs or heart, restriction of respiratory movement by thoracic deformity, by pain, by constriction of bandages, by the pressure of clothing, or by abdominal distension as from meteorism or pregnancy. Extensive pulmonary consolidation, the presence of pleural effusion, or reflex paralysis of the diaphragm, and

the failure of the heart muscle, are factors incidental to the disease.

We can avoid constriction of the chest ; we can annul pain by morphia ; we can relieve meteorism by a turpentine enema, a rectal tube, or a hypodermic injection of pituitary extract. But, from whatever cause the anoxæmia arises, the important question for treatment is : Can we increase the percentage of oxygen in the air reaching unaffected portions of the lungs ? The answer is in the affirmative, both on clinical and chemical evidence. There are many who say that they have never seen oxygen do any good, and it is true that the patient and his friends often think the giving of oxygen is an evil omen. This is because oxygen is either given too late, or is given in a manner which cannot possibly ensure a sufficient concentration in the healthy alveoli. It should be given at the first sign of cyanosis ; indeed, some physicians recommend that it should be given more or less continuously from the commencement of the illness. But if given by a funnel held somewhere near the patient's mouth it has no therapeutic value whatever ; the funnel must be held closely over the mouth and nose for any appreciable benefit to follow. Better than the funnel method is the nasal catheter strapped in position (7), or a mask with a valve which opens easily on expiration. Given thus, very appreciable results are seen in the relief of cyanosis, and in the increased general comfort of the patient ; restlessness may cease, delirium be calmed, even cough be subdued, and sleep ensue. The frequency and



duration of its administration must be determined by the condition of the patient, for its effect is only temporary. It may be given continuously, or for five to ten minutes every half-hour or hour. Portable tents and oxygen chambers are as yet of scientific rather than practical interest. Passage of the oxygen through alcohol has no advantages, nor is it necessary that the oxygen should be warmed between the cylinder and the patient.

The method which I have employed during the last four years, in some hundreds of hospital cases, is the mask method, using the "Apneu" inhaling apparatus, in which the oxygen at a measured rate of flow (3-5 litres per minute) is passed through oily solutions of drugs, such as adrenaline, camphor, and menthol. Very rarely do patients resent the mask, frequently they ask for the inhalation to be repeated, and all the medical men and nurses who have watched the treatment have been greatly impressed with its value in relieving symptoms.

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صورت میں ایک آنہ یومیہ دیرانہ لیا جائیگا۔

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